



Suzaku News You Can Use

Volume 1 - Number 5

25 July 2006

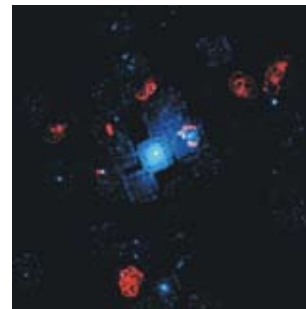
In this issue...

Latest Mission News	p. 1
Resources For All	p. 1
About The Crew ..	p. 2
Objects of Interest	p. 3
Trivia Question:....	p. 4

Latest Mission News

- **Targets for July and August**
- **A Change of Pace**

Don't think that Suzaku is only interested in supernova remnants! The rest of this summer observations of more distant objects and groups of objects have been scheduled. Some of these objects are active galactic nuclei, a class of galaxies which spew massive amounts of energy from their centers, thought to be due to supermassive black holes located there.



Galaxy clusters are another type of target. One of the most important realizations that we have come to in the last 50 years is that the universe is not evenly distributed - not homogeneous - regarding matter. Now know there are hundreds of billions of galaxies in the universe and that they tend to clump together, but we still have a lot left to learn about galaxy clusters. The central areas of these clusters often emit no visible light but are strong X-ray sources. The image you see here is a composite of radio and X-ray observations of our own galaxy supercluster.

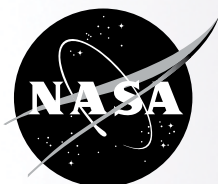
In a future newsletter we plan to look at the galaxy cluster AWM 7. Though we probably won't find Princess Leia or Luke Skywalker in Suzaku's study, we may find other secrets to what happened "long, long ago, in a galaxy far, far away".

Resources For All

- **"Ready made" lesson ideas for the first week of science class**

"... my U3A students will be thrilled to examine the NASA educational materials, I am quite sure, as they avidly read each of your Suzaku E/PO newsletters...I have given them the Einstein Riddle as a Class Exercise and I am quite enthusiastic that they will provide a solution."

While it is always nice to hear positive feedback, comments of any kind are usually helpful. This response came from the winner of the trivia contest



Suzaku News You Can Use

for Suznuz #3 but provides an excellent idea as to how to use us to make the first part of your course easy. It seems traditional to use the scientific method or process as a topic for discussion at the beginning of a science course. In fact, both state and national standards recognize that understanding the “nature of science” is an important facet of science education.

Teaching suggestion to bring authentic, effective scientific process discussion into the light: Use the Suznuz newsletters as source material to work through the first week of your course! One way to do this is to present the steps in the scientific method/process and ask students to identify each as often as possible in the text of the newsletters. This can be extended to a group activity where each group is responsible for one of the newsletter, and then expected to “report out” to the class. Hold one newsletter in reserve if you wish, and use it as an assessment. Instead of using entire newsletters, which are written for an audience of teachers, you may wish to edit some for such an activity.

More specifically, consider from Newsletter 1 “A Brief History...” which recounts Roentgen’s discovery. In a class room, one might ask, “What parts of the scientific process are represented in this article?” Answer: Question/problem, experimentation/data collection, peer review are clearly described. This then gives rise to either moving on, providing more background (ex. data collection sometimes looks like an image, not just measurements), or “Why was the period of peer review so short?”

Archived newsletters may be found at: <http://suzaku-epo.gsfc.nasa.gov/docs/suzaku-epo/newsletter/archive.html>. To view some ready-made activities based on the Suzaku mission go to: <http://suzaku-epo.gsfc.nasa.gov/docs/suzaku-epo/education/lessons/lessons.html>.

EDUCATORS — WE NEED YOU!!!: We are hoping that you might be the type of educator who enjoys reviewing classroom activities, or even perhaps using them in your classroom. If you are, we would be interested in having you review and/or classroom-test the activities that have been developed around Suzaku in their classroom. Please respond to suznuzquiz@athena.gsfc.nasa.gov and we will respond in short order.

About The Crew

— Featuring Scientist Randall Smith



What are your hobbies?

RS: I play chess, juggle, and root for the Red Sox...

What is/was your role for Suzaku?

RS: Before launch, I was responsible for documenting how astronomers can use Suzaku to observe X-ray sources, which meant speaking to all the instrument builders and collecting their information into a single book. My main responsibility was to improve

Suzaku News You Can Use

the tools and models we were going to use to study the high-spectral-resolution data expected from Suzaku and determine what it was telling us. However, after the XRS failure, this was no longer urgent, and as a result I changed jobs. Satellite science can be risky that way, although the rewards are big as well.

From high school to the present, were there any interesting twists and turns or ironies concerning what you planned to do and where you are now?

RS: In college I worked one summer on COBE, the Cosmic Background Explorer. This was a NASA mission to study the leftover light from the Big Bang, and it was a big success in understanding how the universe evolved. When I was choosing which graduate school to attend, I was offered a position working on another Big Bang project but turned it down because I thought COBE had already answered all the big questions and it would be decades before anything interesting happened. Instead I chose X-ray astronomy, which was about to launch some major satellites, and I thought there would be a lot of great new results. As it turns out, I was right about X-ray astronomy, but wrong about the Big Bang being a solved problem -- COBE was only the start, and now everything I learned about the early Universe in graduate school is all out of date. It shows how hard it is to know where research will go -- the Universe can really surprise you!

What is the most exciting part of your current work?

RS: I have a lot of freedom to pick what I'll work on. Of course, I'm an astrophysicist so I'm going to pick astrophysical projects, but that's not much of a limitation. Recently, the INTEGRAL gamma-ray satellite found about 10 neutron stars circling regular stars, where the neutron stars seem to be encased in a dense shell of material, but the stars they're circling are normal. I proposed to observe 5 of these systems with Suzaku and was granted time, and hopefully will be able to figure out what's going on in these systems. I haven't studied these kinds of stars before, but then again they're new to everyone, so it's not too big a disadvantage. That's pretty exciting.

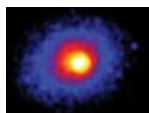
More about INTEGRAL at: http://heasarc.nasa.gov/docs/integral/inthp_about.html.

Objects of Interest

— What are galaxy clusters, and why are they interesting?



If one were able to observe our universe as a whole from the outside, the largest structures would appear as clumps of grouped galaxies. These “galaxy clusters” are groups of hundreds of galaxies and hot gas attracted by gravity. Galaxies emit visible radiation and are easy to “see”. But with temperatures up to about 100 million degrees Celsius, they also emit X-rays, making X-ray observation of them very interesting!



The Centaurus cluster (named for the constellation we would look toward to find it) is

Suzaku News You Can Use

about 150 million light years from Earth. The images to the left are both of the cluster. While the top is a visible image, the image below shows a hot core of X-rays emitted from the center, where we see “empty” space in the visible image. One might think differently about “empty space” from this point on!

It is believed that a great deal more gravity is required to hold these clusters together than that from the matter we see, so dark matter must make up the rest of the mass. Dark matter is, by definition, matter we cannot detect, except for the fact that it shows gravitational effects on other matter. As we observe them today, galaxy clusters seem to be mostly dark matter. By detecting X-ray emissions, Suzaku will extend measurements of the temperature distribution and elemental composition of gases to the outskirts of galaxy clusters, which may help in modeling where the dark matter is.
http://imagine.gsfc.nasa.gov/docs/features/exhibit/astroe2_clusters.html.

Trivia Question:

It’s summer (at least in the northern hemisphere!) so we will give you an easy trivia question about galaxy clusters: Our galaxy is part of a cluster, and in turn, a cluster of clusters known as a “supercluster”. Name the cluster and supercluster of which we are a part. The first person to answer correctly... will win educational materials from the Imagine the Universe! team.

Congratulations to the winner of the previous trivia quiz!: the Gauthiers of Gonzales, La.